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# Role of the External Nasal Dilator in the Management of Nasal Obstruction

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**The aim of this study is to evaluate the effect of an external nasal dilator in patients with nasal obstruction secondary to mucosal congestion (n = 33) or to septal deviation in the nasal valve area (n = 28). A group of subjects with healthy nasal cavities was tested also (n = 51). Acoustic rhinometric and rhinomanometric nasal measurements were performed with and without the dilator and before and after topical decongestion of the nasal mucosa. A visual analog scale was employed to evaluate the subjective sensation of nasal obstruction. Objective measurements showed that the external dilator increased the minimum cross-sectional area and decreased the nasal resistance significantly in all three groups ($P < 0.01$). The effect was more impressive in patients with septal deviation ($P < 0.001$). Subjective assessments reflected patency in all subjects except those in the mucosal swelling group ($P = 0.06$). From this study the authors conclude that the external nasal dilator offers an effective, nonsurgical therapeutic approach in the management of septal deviation that obstructs the nasal valve area. Although patients with nasal obstruction secondary to mucosal congestion showed objective improvement with the nasal dilator, these changes were not accompanied by a sensation of enhanced patency.**

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## INTRODUCTION

The Francis alae nasi prop[1] was probably the first nasal dilator to be reported as useful for the relief of nasal obstruction at the nasal valve area. Other internal metal devices such as the open paper clip have been used experimentally and clinically with transnasal[2] and anterior[3,4] rhinomanometry to quantitate the resistive component of the nasal valve. A plastic nasal dilator, also inserted into the nasal vestibule, has been tested in normal subjects[5] and snorers.[6] This produced a significant reduction in the nasal resistance to respiratory airflow. More recently, a nasal dilator applied to the skin overlying the compliant soft tissues of the anterior nose was evaluated with acoustic rhinometry.[7] Roithmann et al.[8] showed that the external nasal dilator increases the cross-sectional area of postrhinoplasty collapsed nasal valves with symptomatic relief of nasal obstruction.

The purpose of this study is to further evaluate the effect of the external nasal dilator on nasal obstruction. More specifically, the study aims, first, to evaluate the effect of the external nasal dilator in patients with nasal obstruction secondary to anterior septal deviation and to mucosal congestion and, second, to compare the efficacy of the external nasal dilator with topical decongestion of the nasal mucosa.

## MATERIALS AND METHODS

The measurements were performed at the Saul A. Silverman Nasal Airflow Laboratory and Clinical Investigation Unit at Mount Sinai Hospital, University of Toronto, Ontario, Canada.

### *Subjects*

Healthy volunteers from medical and paramedical personnel and patients attending the Department of Otolaryngology, Mount Sinai Hospital, were divided in three groups by history, rhinoscopy, and nasal airflow resistance, as follows:

1. Group A (healthy nasal cavities): Asymptomatic, no major structural or mucosal obstruction of the nasal cavities and unilateral nasal resistance less than 0.35 ± 0.05 Pa/cm$^3$/second.
2. Group B (structural abnormalities): Nasal obstruction by anterior septal deviation with at least 50% of blockage and nasal resistance greater than 0.4 Pa/cm$^3$/ second.
3. Group C (mucosal abnormalities): Nasal obstruction by mucosal swelling with at least 50% of blockage and nasal resistance greater than 0.4 Pa/cm$^3$/second.

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Patients with nasal septum perforation or in chronic use of topical or systemic nasal decongestants, antihistamines, or corticosteroids were excluded from the study.

### *Assessment of the Sensation of Nasal Obstruction*

Subjects were asked to assess their own nasal patency on a 100-mm visual analog scale[9] with the nose untreated, with the external dilator, and after the application of a topical decongestant. The scale was designed with one extreme being "my nose is completely free" (0 mm) and the other being "my nose is completely blocked" (100 mm).

### *Acoustic Rhinometry and Rhinomanometry*

Nasal minimum cross-sectional area and nasal volume were computed by means of an Eccovision Acoustic Rhinometer (Model AR-1003, Hood Laboratories; Pembroke, MA). This instrument measures reflected sound waves arising from the nasal cavity in response to an incident sound wave and converts these measurements into cross-sectional dimensions. The technique and protocol have been previously described in detail.[7] Four curves and computed dimensions were collected for each nasal cavity and their average calculated for the untreated nose, the nose managed with the external dilator, and the nasal mucosa topically decongested.

The resistance to airflow based on the average of separate measurements of unilateral nasal cavities was measured by pernasal rhinomanometry with a head-out, displacement type, body plethysmograph.[10,11]

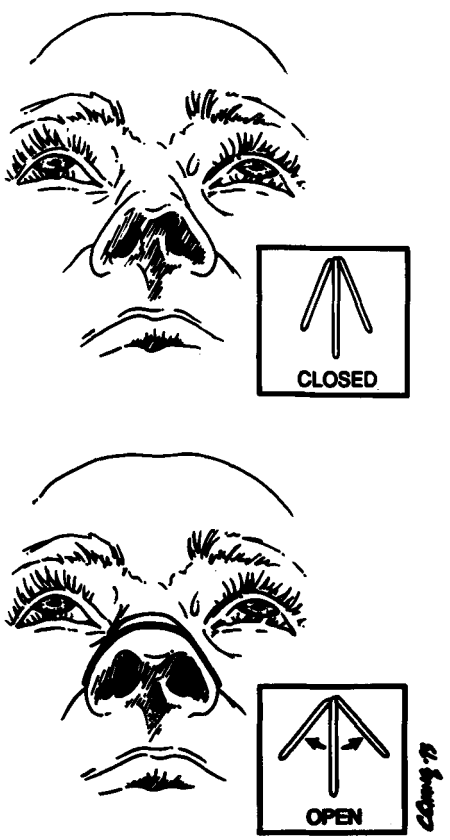


Fig. 1. Mechanism of action of the external nasal dilator. (From Roithmann R, et al. *Am J Rhinol* 1997;11:387–93; with permission.)

### *Nasal Dilator*

The external nasal dilator (Breathe Right, CNS, Inc.; Chanhassen, MN) is a spring-loaded plastic strip that, by adhesion to the skin overlying the compliant soft tissues of the anterior nose, dilates the lumen (Fig. 1).

All subjects were tested after having been seated for 30 minutes in order to achieve a resting state and acclimatization to the laboratory environment. After measurements were obtained from the untreated nose, the external nasal dilator was applied and a second series of measurements was obtained. The dilator was removed, and measurements were repeated 10 minutes after the topical application of 0.1% xylometazoline.

Analyses of variance (ANOVAs) followed by Tukey's pairwise comparisons were carried out. A value of $P < .05$ was considered significant.

## RESULTS

Table I shows the sex and age distribution of those in groups A (healthy nasal cavity), B (anterior septal deviation), and C (mucosal congestion).

Table II shows the median and range minimum values for cross-sectional area and nasal resistance for all groups before and after external dilation or topical decongestion.

In group A, both the external dilator and the decongestant increased the minimum cross-sectional area and decreased the nasal resistance ($P < .001$). Objective improvement was associated with a sensation of enhanced nasal patency in the majority of these subjects. The external dilator was more effective than the decongestant in increasing minimum cross-sectional area ($P < .0001$). They were equally effective in reducing the nasal resistance ($P = .6$) and improving the sensation of nasal patency ($P = .4$).

In group B, both the external dilator and decongestant increased minimum cross-sectional area, decreased the nasal resistance, and enhanced the sensation of nasal patency (Fig. 2). These effects were more pronounced with the external nasal dilator than with the decongestant (Fig. 3).

In group C, as with the other groups, objective measurements of patency were improved by both external dilator and decongestant. However, the decongestant was much more effective in reducing the nasal resistance than the nasal dilator ($P < .0001$). These patients did not sense increased nasal patency with the external dilator ($P = .06$) (Fig. 2). The nasal volume at a distance of 4 to 8 cm from the nostril was not affected by the external dilator ($P = .3$). Topical decongestant increased significantly the nasal volume in the anterior (0 to 4 cm) ($P < .001$) and the posterior segment (4 to 8 cm) of the nasal cavity of these patients ($P < .0001$).

TABLE I.
Age, Sex, and Number of Nasal Cavities in Each Group.

| | No. | Median Age (y) | Age Range (y) | Men (n) | Women (n) |
|---|---|---|---|---|---|
| Group A | 51 | 34 | 16–66 | 26 | 15 |
| Group B | 28 | 34 | 17–66 | 20 | 8 |
| Group C | 29 | 26 | 16–49 | 20 | 9 |

TABLE II.
Minimum Cross-Sectional Area (MCA = $cm^2$) and Nasal Resistance (NR = $Pa/cm^3/s$).

| Group | MCA Baseline | MCA Dilator | MCA Decongested | NR Baseline | NR Dilator | NR Decongested |
|---|---|---|---|---|---|---|
| Healthy | 0.64 ± 0.02 | 0.76 ± 0.02 | 0.7 ± 0.02 | 0.26 ± 0.01 | 0.2 ± 0.01 | 0.19 ± 0.01 |
| Septal deviation | 0.31 ± 0.02 | 0.55 ± 0.03 | 0.37 ± 0.02 | 0.79 ± 0.1 | 0.39 ± 0.07 | 0.55 ± 0.09 |
| Mucosal congestion | 0.45 ± 0.03 | 0.56 ± 0.03 | 0.61 ± 0.02 | 0.93 ± 0.1 | 0.71 ± 0.08 | 0.27 ± 0.09 |

Numbers express the mean ± standard deviation.

## DISCUSSION

This study has shown that the application of an external nasal dilator increases objective measures of nasal patency substantially and produces marked symptomatic improvement in patients with nasal obstruction attributable to septal deviation in the nasal valve area. Subjects with healthy nasal cavities who wore the dilator also demonstrated an increase in nasal minimum cross-sectional area and a decrease in nasal resistance that was accompanied by a sensation of greater freedom of breathing. Although patients with mucosal congestion showed objective improvement with the external dilator, these changes were not accompanied by a sensation of enhanced patency. Analyses of the effects of the dilator and the decongestant on nasal volume might explain this finding. The dilator did not reduce the obstructive effect of mucosal congestion within the rigid bony cavum.

The mechanism of action of the external nasal dilator is simple and similar to the Cottle test.[12] In the Cottle test the examiner opens the valve by pulling the cheek away from the midline. Similarly, the external dilator acts directly on the compliant nasal cartilages and opens the alar segment of the valve by pulling these cartilages in a lateral direction.

In our previous study[8] the nasal dilator was found to increase cross-sectional area and to markedly alleviate nasal obstruction attributable to valve collapse after rhinoplasty. Our present findings indicate that the external nasal dilator is useful also when the nasal septum is the obstructive component in the nasal valve area. It is important to note that this was a momentary measurement; it would be interesting to test subjects and patients for a prolonged period to determine whether the effect is maintained.

Nasal obstruction has been linked to snoring and obstructive sleep apnea syndrome (OSAS).[13–15] Although nasal dilators reduce nasal resistance substantially, there are conflicting results about their role in alleviating snoring and OSAS. Höjner et al.[16] tested 11 habitual snorers and/or OSAS patients with healthy noses and found that an internally placed nasal dilator (Nozovent) alleviated snoring and decreased both the frequency and severity of obstructed breathing episodes. However, Hoffstein et al.[17] tested the same device in 15 snoring patients with healthy noses and a suspicion of sleep apnea and could not demonstrated any effect on the apnea/hypopnea index and oxygen saturation, with only a minor effect on snoring during slow-wave sleep.

Portugal et al.[18] have recently undertaken an objective assessment of the effect of the external nasal dilator (Breathe Right) during exercise. Twenty healthy subjects tested with rhinomanometry and acoustic rhinometry while wearing this external nasal dilator experienced subjective improvement of nasal breathing both at rest and during exercise. The subjective response, however, was not consistently associated with an objective improvement. Indeed, some subjects demonstrated a paradoxical worsening of the nasal airway while wearing the device.

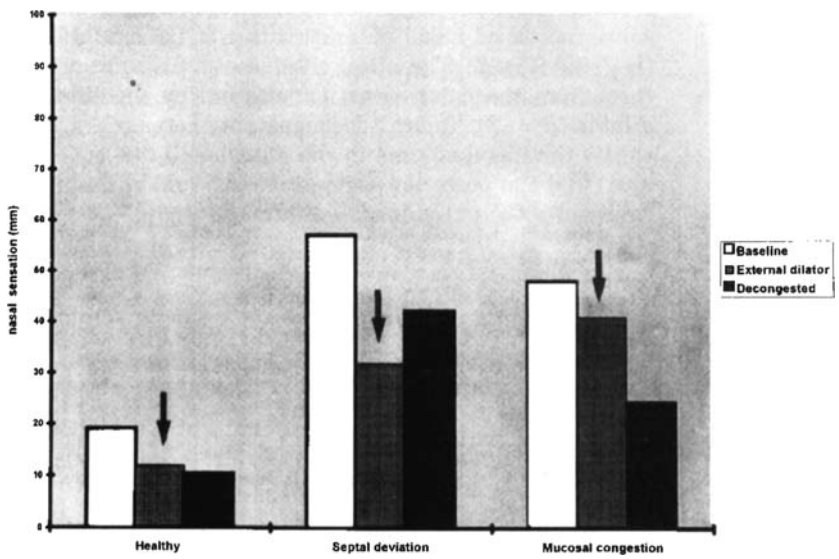


Fig. 2. The effect of the external dilator (arrows) and the decongestant on nasal sensation in healthy and obstructed nasal cavities.

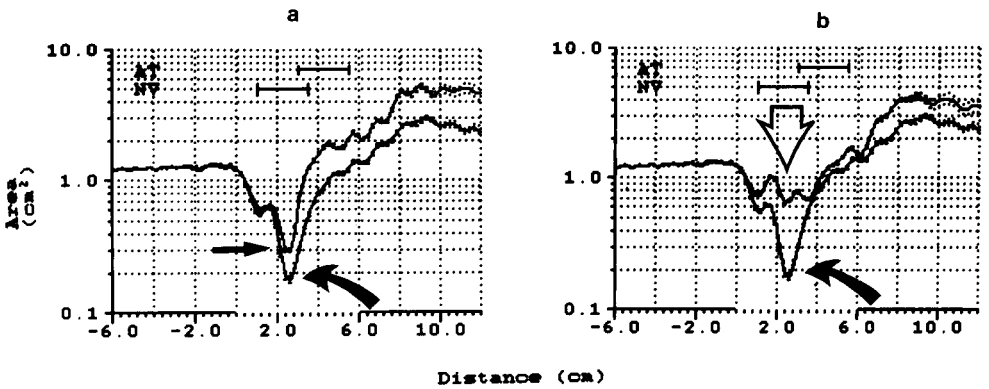


Fig. 3. An example of the area-distance curve in group B (anterior septal deviation). **(A)** The decongestant produced a small increase in the minimum cross-sectional area (straight arrow). Curved arrow = minimum cross-sectional area untreated. **(B)** Same nasal cavity as in **A.** Marked effect of the external nasal dilator in the minimum cross-sectional area (straight arrow) is evident. Curved arrow = minimum cross-sectional area untreated.

## CONCLUSION

Current investigations clearly indicate that insertion of the external nasal dilator (Breathe Right) provides effective relief of nasal obstruction secondary to structural abnormalities in the nasal valve area. However, there is no evidence that the device is useful in treatment of medical conditions associated with nasal mucosal congestion such as in allergic, vasomotor, or infectious rhinitis. The role of nasal dilators to improve breathing in exercise and in the treatment of snoring requires further investigation.

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